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NUTRITIONAL NIGHT BLINDNESS

by

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HOUSE FOR THE BLIND**

An analysis of this case indicates that for several years previous to the first admission to the hospital the patient had a mild degree of asthma which was not sufficiently severe to require medical intervention, but that with the onset of pregnancy the asthmatic condition became more pronounced. Although delivery gave relief for a few months, the asthma has now become a specific entity and is not affected by any obstetric condition. Here, a marked endocrine dysfunction is apparent, but the patient is also definitely sensitive to exogenous influences, and the case appears to fall in group I, subgroup 2.

CONCLUSIONS

1. In a patient with true bronchial asthma of anaphylactic origin, the attacks are markedly exacerbated by pregnancy and the outlook can become alarming.

2. In the type of bronchial asthma which is directly related to the sexual cycle, the attacks may appear with each menstrual period, be absent during pregnancy and lactation, and then recur with the reestablishment of the menses.

3. On the other hand, attacks may occur only during pregnancy or even only during pregnancy with one sex and not with the other.

4. The attacks are occasionally associated with a mild toxemia and are relieved when the toxemia is cleared up under conservative treatment.¹⁰

5. Treatment consists of combating the asthma and disregarding the pregnancy.

6. Termination of pregnancy at best assures only the pregestational state.

7. When the attacks are not accompanied by toxemia but are due specifically to pregnancy, therapeutic abortion might be warranted in extreme cases.

8. Attacks of bronchial asthma are a decided menace to the welfare of the fetus.

2021 West Girard Avenue.

AMEBIASIS

INCIDENCE IN PRIVATE PRACTICE

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Most of the published reports on the incidence of human intestinal protozoa in the United States are based on studies of patients in charitable institutions; that is, indigent persons. The present survey is offered to show the incidence of intestinal protozoa in individuals of a higher social status. It is a summary of the results of routine examinations of the stools of 1,852 patients from the private practice of the Rees-Steady Clinic during the past four years. With the exception of an insignificant number of Mexican families of the better class, the material for this study came from American homes of San Diego city and county.

This study was not limited to patients with gastrointestinal complaints. Many of these examinations formed a part of the routine general examinations of patients with more or less indefinite symptoms and the results therefore constitute a fair estimate of the incidence of protozoa in general private practice.

Patients were given printed instructions regarding the obtaining of the specimens and were asked to sub-

mit three fecal specimens on consecutive days. The first, a liquid specimen, was collected in the laboratory following a saline cathartic. This was kept in a warm cabinet until the examination was completed. Subsequent specimens were brought to the office in paraffined paper cartons. A number of patients failed to submit the desired number of stools and in some cases only one specimen was obtained.

For the detection and identification of protozoa, a combination of the cover-glass preparation in physiologic solution of sodium chloride and a modification of Donaldson's iodine-cosin mixture¹ was employed. At first, permanent preparations stained with Haiden-hain's iron-hematoxylin were used. It was soon found, however, that it was not necessary to resort to this procedure except in rare instances. In many specimens in which there were only a few parasites it was our experience that all the protozoa disappeared from the slides during the iron-hematoxylin staining. Further-

TABLE 1.—Results of Examinations

	1,339 Adults 3,224 Examinations, 2.5 per Case		513 Children 738 Examinations, 1.43 per Case*	
	Number	Per Cent	Number	Per Cent
Endamoeba histolytica.....	31*	2.3	2	0.4
E. coli.....	227	16.2	21	4.0
E. f. coli.....	117	8.7	16	3.1
Ictioamoeba.....	9	0.6	9	0.9
Chilomastix.....	153	11.5	9	1.7
Giardia.....	83	6.1	19	3.7
Trichomonas.....	48	3.5	2	0.4
Embeidomonas.....	34	2.5	0	0

* Includes three nonresidents.

more, these preparations rarely disclosed parasites that had not been previously detected. This has been the experience of other workers also. With the iodine-cosin mixture properly adjusted, the cysts appear as bright yellow circles in a red field; the flagellates and motile amebas stain red. The oil immersion objective was used to study the internal structure. In almost every case the cysts of *Endamoeba histolytica* can be identified in the cover-glass saline solution preparation by their large highly refractile chromatoidal rods. The identification of motile forms is frequently difficult. Good illumination is absolutely essential and we are using with satisfaction the Bausch and Lomb adjustable microscope lamp with a Corning Daylite glass.

The results of the examinations in the cases of 1,339 adults and 513 children are given in table 1. The cases in children are listed separately to show the low incidence of protozoa as compared to adults. *Endamoeba histolytica* was found in thirty-one adults, or 2.3 per cent, and in two children, or 0.4 per cent. Combining these results gives an incidence of 1.7 per cent. In three of our adult cases the infestation undoubtedly occurred outside the United States, as two cases were from families of United States naval officers who recently had returned from the Orient, and the third case was that of a missionary who recently had returned from India. If these cases were not included, the incidence among the adult permanent residents would be reduced to 2.1 per cent. In this series only one case of frank amebic dysentery was encountered and that was in a 5 year old child. In only four cases were cysts absent from the stools.

1. Saturated solution of eosin in physiologic solution of sodium chloride, 1 part; 5 per cent potassium iodide in physiologic solution of sodium chloride saturated with iodine, 1 part; physiologic solution of sodium chloride, 2 parts. These solutions are kept in separate dropping bottles and mixed fresh daily.

10. Williams, J. W.: Textbook of Obstetrics, New York, D. Appleton & Co.
From the Rees-Steady Clinic.

Table 2 compares the results of this survey with surveys made elsewhere. The incidence of *Endamoeba histolytica* varies from 0.2 to 15.58 per cent in the different studies. There is no doubt that the incidence varies with the class of patients and the geographic location. One cannot but wonder why, in view of the large number of people harboring this parasite, so few cases with frank amebic dysentery are seen and why there are not more local epidemics like the recent outbreak in Chicago.

It has been stated repeatedly that a single fecal examination will reveal only about half the protozoa that can be detected by multiple examinations. That has not been our experience, as is shown by table 3, which is an analysis of the positive cases. In the thirty-three cases of infestation with *Endamoeba histolytica*, the parasite was found in the first specimen in thirty-one cases, in the second in one case and not until the third examination in one case. The fact that the first specimen was collected following a saline cathartic

NUTRITIONAL NIGHT BLINDNESS

REPORT OF A CASE

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Night blindness, sometimes called hemeralopia or nyctalopia, which is a difficulty in adapting, or an inability to adapt, the faculty of vision to very faint illumination, may result from nutritional deficiency as well as from intra-ocular disease. It was recognized at the time of Hippocrates that liver or liver and honey was a cure for night blindness. In the past few years, experimental and clinical evidence have demonstrated that night blindness caused by faulty nutrition is the result of deficiency in vitamin A and is not infrequently the first manifest symptom of such deficiency.

TABLE 2.—Comparison of Surveys for Intestinal Protozoa

Source	Place	No. of Cases	Average E. Histolytica per Case	E. Histolytica per Cent	E. Coli per Cent	E. Nana per Cent	Iodamoeba per Cent	Chilomastix	Trichomonas
Boeck and Stiles: Bull. Hyg. Lab., U. S. P. H. S., 1923	U. S. P. H. S. hospitals	8,020	1.6	4.1	19.6	13.3	5.0	6.5	3.1
Williamson, Kaplan and Geiger: J. A. M. A. 102:535 (Feb. 10) 1929	Chicago food handlers	1,148	2	2.35	19.16	2.0	5.31	6.53	1.91
Williamson, Kaplan and Geiger, <i>Ibid.</i>	Hospital Dispensary Chicago	350	1.3	1.65	8.10	0.78	1.06	1.90	1.57
Kessel and Munson: J. A. M. A. 94:1 (Jan. 4) 1930	Los Angeles General Hospital	2,731	2	0.8	15.2	16.0	3.2	4.4	8.3
Andrews and Paulson: Am. J. M. Sc. 181:102 (Jan. 1) 1931	Hospital outpatients, Baltimore	522	1	0.2	4.2	2.5	1.3	2.7	1.3
Faust: Am. J. Trop. Med. 11:291 (May) 1931	Charity patients Private patients New Orleans	620 380	....	15.58 8.66	....	....	....	....	....
Meleney: J. Lab. & Clin. Med. 19:113 (Nov.) 1933	In and outpatients, Nashville	2,112	1	3.0	12.7	7.3	3.2	5.5	3.5
Magath: Proc. Staff Meet., Mayo Clin., 8:703 (Nov. 22) 1933	Mayo Clinic	....	....	24.03	....	....	....	....	....
Sumerlin	Adult private patients Children San Diego	1,339 513	2.5 1.42	2.3 0.4	16.2 4.0	8.7 3.1	0.6 0.6	3.4 2.7	11.5 1.7

TABLE 3.—Analysis of Positive Cases

	Number	Per Cent
Positive on first examination.....	564	92.2
Positive on second examination.....	28	6.2
Positive on third examination.....	10	1.6

probably explains these results. We found, however, that in some cases subsequent examinations revealed other species of protozoa not found on the first examination.

SUMMARY

1. During four years, a survey for human intestinal protozoa among 1,852 private patients was made. The incidence among 1,339 adults and 513 children was noted.

2. The incidence of *Endamoeba histolytica* among 1,336 adult permanent residents of San Diego city and county was 2.1 per cent, and among 513 children was 0.4 per cent.

3. A single fecal examination will reveal the protozoa actually present in over 90 per cent of the cases, if a liquid specimen is collected following a saline cathartic and examined while warm.

2001 Fourth Avenue.

The most familiar form of deficiency of vitamin A, xerophthalmia, both of infants and of adults, especially the latter, is extremely rare in the United States. This is largely because vitamin A or its precursor, carotene, is widely available in foodstuffs, and the body ordinarily stores large quantities of this substance, a fact not true of some of the other essential foodstuffs. Although nutritional night blindness is not uncommon in the Orient¹ and in some European states,² it probably is extremely rare in this country and there are few if any authentic cases reported as having occurred in the United States.

Disease caused by deficiency of vitamin A may result: (1) from reduction of adequate intake of vitamin, as the available food supply may be poor in it, (2) from deficient absorption and storage as the result of intestinal or hepatic derangement or disease, (3)

From the Division of Medicine, the Mayo Clinic.

Since submission of this paper for publication, our attention has been called to a report of a case of night blindness due apparently to vitamin A deficiency, presented by Dr. D. L. Tüderquist of Duluth at the meeting of the Minnesota State Medical Association in May, 1933. The report of this case, which was observed in 1927, will be published in Minnesota Medicine.

1. Mori, M.: Ueber den sogenannten Hikari (Xerosis conjunctivae infantum etc. Keratomalacie), *Jabrb. f. Kinderh.* 50:175-195, 1904. Pillat, Arnold: The Main Symptoms of the Eye in Vitamin A Deficiency in Adults, *Nat. M. J. China* 15:614-620 (Oct.) 1929.

2. Bloch, C. E.: Effects of Deficiency in Vitamins in Infancy: Caries of Teeth and Vitamins, *Am. J. Dis. Child.* 42:263-278 (Aug.) 1931. Spence, J. C.: A Clinical Study of Nutritional Xerophthalmia and Night-Blindness, *Arch. Dis. Childhood* 6:17-26 (Feb.) 1931.

from altered metabolism of the vitamin in the body,³ and (4) from the increased demand for and consumption of the vitamin, for example during periods of rapid growth, pregnancy or disease, especially during severe infectious diseases when the basal metabolic function may be greatly enhanced. McCollum and Simmonds⁴ have emphasized the fact that it is doubtful whether a deficiency disease ever occurs uncomplicated in man or in animals and that deficiency diseases, with the possible exception of scurvy, can be produced as uncomplicated syndromes only by carefully planned experimental diets.

The versatility of vitamin A has only recently been appreciated. A remarkably increasing literature, which we⁵ recently reviewed, testifies to its growing importance in the chemistry of food and nutrition, not only in the prevention and cure of certain ailments of man but when supplied in liberal proportion, in the maintenance of a satisfactory state of nutrition and a high degree of health and vigor, both in the growing child and in the adult.

Because of the extreme rarity of case reports of nutritional night blindness occurring in the United States, and in order to emphasize the fact that even though the daily intake of an individual is adequate, a state of nutritional deficiency may result, the following case has been thought worthy of presentation:

REPORT OF CASE

A man, aged 48, a civil engineer, registered in the clinic, June 5, 1933, because of diarrhea of two years' duration. Since the age of 18 years he had had symptoms of duodenal ulcer, for which gastro-entrostomy had been performed at the clinic in 1919. Ten years subsequently, symptoms of jejunal ulceration developed and two years thereafter symptoms of gastrocolic fistula appeared. During this period of two years he had continued on a diet which was quantitatively and qualitatively adequate for proper nutrition. In the course of the diarrhea he had passed from four to six liquid or soft stools daily and the stools often had contained undigested particles of food. Physical examination at the time of admission in 1933 revealed a general cachectic state, which will be considered subsequently. Surgical repair of the gastrocolic fistula was performed early in June, and from this surgical procedure the man made an uneventful convalescence.

The first symptoms of night blindness had developed about April, 1932, one year after onset of the diarrhea. The patient, who because of his gastro-intestinal disabilities had not done any work since 1928, had become interested in the discussions regarding a municipal power plant in the small city in Missouri where he resided. One of the reasons for his interest was that the street lights had appeared amber colored and dim, and he had also noted that the lights in his house were dim. He had complained bitterly about this for some time before he had appreciated the fact that the trouble was his inability to see the lights as well as formerly. In the daylight he could see satisfactorily. In June, 1932, he had attended a fish supper, and about 8 o'clock in the evening, when it had become dark, he was unable to get around satisfactorily and walked over the grates where the fish were being cooked, burning his feet in the coals and stumbling over several objects. Since that time he had noted that on coming from the bright outdoors into the house, he would be unable to see details for about five minutes. If there was a clock or a picture on the wall, he would be unable to tell the time and unable to distinguish the details of the picture for

about five minutes. One evening, when coming out of church, the exit from which was very brightly lighted artificially, he had bumped into several people without realizing that any one was in his way until he came in contact with them. He had had similar experiences on the street at night. He had fallen over steps which he did not see and at one time he had tripped over a dog, which was sleeping in his pathway. One of the greatest difficulties he encountered was driving a car at night. He usually was able to do this by focusing on a light in the distance, but by so doing he was unable to tell whether he was on the shoulder or on the wrong side of the road. If he put on the dimmer lights, which would illuminate the street directly in front of the car, he was able to get along fairly satisfactorily. Although he had driven into the driveway leading to his garage many hundreds of times, he had a great deal of difficulty in finding the driveway and on one occasion drove up onto the lawn and to the front steps of his neighbor's house.

The night blindness occurred periodically. As a rule, the patient had periods of from two to three days to seven to ten days in which the night blindness was present, with free intervals between of from one to four weeks. There was no apparent cause for the exacerbations or remissions of symptoms. In addition, the onset of a period of night blindness was usually slow, occupying from one to three days, usually the latter, whereas the attack usually subsided in one day. Peripheral vision seemed somewhat better to him than central vision.

Since the time of the repair of the gastrocolic fistula, there has been complete freedom from night blindness, and this has been the longest period of freedom from the disability since its onset. At the time of the patient's dismissal from the clinic, five weeks after operation, his weight was 6 pounds (2.7 Kg.) lower than before operation, but diarrhea and abdominal symptoms were absent and his diet was satisfactory.

Ophthalmologic examination made by Dr. W. I. Lillie, post-operatively, disclosed the following: The pupils reacted normally, the media were clear, and the fundi were normal except for mild sclerosis of the retinal arteries. Presbyopia was present. The perimetric fields were normal.

For two years the patient had lived on a generous diet which contained reasonably large quantities of milk, butter and fresh vegetables, and he ate rather large amounts. At no time during this period did he exist on a diet which in any way could be said to be low in vitamin A or its precursor, carotene.

COMMENT

The physiologic changes accompanying the development of nutritional night blindness are remarkable. They depend on a disturbance in the metabolism of visual purple of the retinal rod cells, which have to do with vision under faint illumination. Under ordinary circumstances of bright light visual purple is bleached, but it is also constantly being regenerated. Experimental evidence indicates that there is a close relationship between vitamin A and the visual purple, since Fridericia and Holm⁶ have shown, and Tansley⁷ has confirmed quantitatively, that there is delay or failure in regeneration of visual purple of animals that are deprived of vitamin A. In addition, the high vitamin A content of the hog's retina has been demonstrated by Yudkin, Kriss and Smith.⁸ It is possible that in the retina there may occur a reversible reaction, vitamin A being required for the production of visual purple, and the latter, under suitable conditions, producing vitamin A. It is obvious that manifestations of night blindness will occur chiefly after exposure of the patient to bright light, for it is in this way that the supply of visual purple is depleted, and ample regeneration can-

3. Strauss, M. B., and Castle, W. B.: Nature of Extrinsic Factor of Deficiency State in Pernicious Anemia and in Related Macrocytic Anemias; Activation of Yeast Derivatives with Normal Human Gastric Juice. New England J. Med. 207:55-59 (July 4) 1932. Minot, G. R.: Some Fundamental Clinical Aspects of the Deficiencies. Ann. Int. Med. 2:216-229 (Sept. 1925). Minot, G. R.; Strauss, M. B., and Cobb, Stanley: "Alcoholic" Polyneuritis: Dietary Deficiency as a Factor in Its Production. New England J. Med. 208:1244-1249 (June 15) 1933.

4. McCollum, E. V., and Simmonds, Nina: The Newer Knowledge of Nutrition, ed. 4, New York, Macmillan Company, 1929.

5. Eusterman, G. B., and Wilbur, D. L.: Clinical Features of Vitamin A Deficiency. J. A. M. A. 98:2054-2060 (June 11) 1932.

6. Fridericia, L. S., and Holm, Eiler: Experimental Contribution to the Study of the Relation Between Night Blindness and Malnutrition: Influence of Deficiency of Fat-Soluble A-Vitamin in the Diet on the Visual Purple in the Eyes of Cats. Ann. J. Physiol. 73:63-78 (June) 1925.

7. Tansley, Katherine: The Regeneration of Visual Purple: Its Relation to Dark Adaptation and Night Blindness. J. Physiol. 71:442-458 (April 24) 1931.

8. Yudkin, A. M.; Kriss, Max, and Smith, A. H.: Vitamin A Potency of Retinal Tissue. Ann. J. Physiol. 97:611-616 (July) 1931.

not occur. This has been convincingly demonstrated by Aykroyd,⁹ who found that, after prolonged exposure to brilliant sunlight with apparent rapid depletion of the visual purple, night blindness in several cases, first developed.

Night blindness may be the result of such intra-ocular diseases as retinitis pigmentosa, optic atrophy, glaucoma and choroiditis, or the disability may be congenital. In the absence of evidence of intra-ocular disease, as in the case reported, night blindness is of the essential type and is usually considered to be the result of nutritional disturbance. There are several factors in the present case which are worthy of note. There were two atypical features. First, the patient regarded the lights at night as amber colored and, second, the night blindness was intermittent. It is possible that the second factor may be explained on the basis of a very close balance between supply and requirements of vitamin A. During the periods of night blindness a negative balance may have existed, and then during periods of remission a positive balance may have been present. That very small amounts of vitamin A will relieve night blindness of patients has been demonstrated by Spence, who eradicated this symptom in from twelve to thirty hours by the administration of one or two small doses of cod liver oil.

It is exceedingly important to note that the dietary intake was apparently adequate. Nutritional deficiency, therefore, is to be explained largely as the result of the presence of the gastrocolic fistula, which allowed food to pass into the colon from the stomach, preventing proper and adequate digestion and assimilation. Evidence that a state of malnutrition was present included the cachectic appearance of the patient, the moderate loss of weight, the occurrence of repeated cutaneous infections, and the presence of acne ceticiorum as well as the night blindness. Spence has noted nutritional night blindness in cases in which patients apparently were well nourished. The only other physical evidence present that might have been the result of deficiency of vitamins was caries of the teeth. This symptom has been shown to accompany deficiency of vitamins A, C and D. The disappearance of the night blindness in the case reported, as a result of surgical repair of the gastrocolic fistula, and the resultant cessation of diarrhea, is another link in the evidence that this symptom was the result of nutritional disturbance. Direct proof that the night blindness was caused by deficiency of vitamin A would have been furnished if parenteral administration of the vitamin had successfully relieved the symptoms. However, it cannot be denied that actual proof of such relationship has not been established in this case. The evidence, although good, is circumstantial and presumptive.

It is conceivable that, with the widespread use by experts of methods for the detection of night blindness, numerous instances of such inability to adapt the vision in part or completely to faint illumination will be noted in this country. Care must be exercised in ascribing such changes to deficiency of vitamin A. It should also be emphasized that clinicians must be on the alert for latent and actual dietary states of deficiency among patients with organic and even functional gastro-intestinal disturbances. Despite an apparently adequate diet, the presence of derangement or disease interfering with normal digestion and assimilation, as in the case reported, may be the underlying factor in

the production of a state of deficiency. General recognition of this fact is highly desirable.

Our interest in disorders caused not only by restricted or unbalanced diet or voluntary prolonged abstinence but by pathologic processes or serious dysfunction of the gastro-intestinal tract gravely interfering with proper nutrition goes back almost a decade. In 1931 Eusterman and O'Leary¹⁰ reported observations concerning thirteen cases of pellagra which developed during the course of disease or dysfunction of the digestive tract. Several similar striking cases of deficiency of vitamin G have been observed since then. We have also seen two cases of pronounced nutritional edema, with the usual marked decrease in the value for total serum proteins, and with disturbed mineral metabolism, following operations for benign lesions of the upper part of the digestive tract, in which the sequelae were those of obstruction of high grade. Fortunately, such instances are extremely rare when operation is carried out by competent, experienced surgeons.

The night blindness in the case here reported also rather convincingly developed as the result of a post-operative complication, in which the clinical feature of deficiency of vitamin A was prominent. In our opinion, this is the first example of a highly probable nutritional night blindness on record in the clinic. It is not unlikely that more meticulous study would have revealed other deficiency disorders in the thirteen cases of pellagra previously reported, for such disorders are usually multiple in man; but the clinical evidence for this was not obvious. Students of nutrition and clinicians have emphasized in recent writings the importance of excluding organic disease of the digestive tract when confronted with a deficiency disorder. Other conditions, formerly not looked on as deficiency diseases, such as pernicious anemia, sprue, gährungsdyspepsie of Schmidt, and idiopathic steatorrhea, are also apparently dependent on a disturbance of gastro-intestinal function, resulting in deficient production, absorption or utilization of one or more essential factors. Also evidence has been advanced recently by Minot¹¹ and Strauss¹² and their associates indicating that the polyneuritis of pregnancy and probably "alcoholic" polyneuritis are deficiency disorders.

It is imperative carefully to investigate the diet of all patients with ill defined complaints, dental defects, lowered resistance to infection, lack of physical well being, inhibition of bodily development and the like. States of partial deficiency may be very common, and the lack of adequate intake of calcium is particularly striking.

SUMMARY

Report of a case of highly probable nutritional night blindness is made because of the rarity of reports of such cases occurring in the United States. The relationship of this symptom to deficiency of vitamin A and the retinal pigment visual purple are considered. It is worthy of emphasis that states of nutritional deficiency may arise, as in this case, not as a result of inadequate intake of vitamins or other foodstuff but as a result of gastro-intestinal or other disturbances interfering with either the normal digestion and assimilation of foodstuffs or their metabolic activity.

10. Eusterman, G. B., and O'Leary, P. A.: Pellagra Secondary to Benign and Carcinomatous Lesions and Dysfunction of the Gastro-Intestinal Tract: Report of Thirteen Cases, *Arch. Int. Med.* **47**: 633-649 (April) 1931.

11. Minot, Strauss and Cobb.³

12. Strauss, M. B., and McDonald, W. J.: Polyneuritis of Pregnancy: A Dietary Deficiency Disorder, *J. A. M. A.* **100**: 1320-1323 (April 29) 1933.

9. Aykroyd, W. R.: Night-Blindness Due to Vitamin Deficiency, *Tr. Ophth. Soc. U. Kingdom* **50**: 230-237, 1930.

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